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ABSTRACT

Water is one of the most polluted resources in our environment. Since everyone has the same basic need for pure water, it follows that all people should have a basic knowledge of the causes, results and solutions to the water pollution problem. This unit is designed for use with Level II and III educable mentally retarded students to present information on water pollution on the following four topics: (1) The Importance of Clean Water, (2) Sources of Water Pollution, (3) Effects of Water Pollution, and (4) Solutions to Water Pollution. For each topic there are behavioral objectives, student activities and teacher suggestions. The appendix includes teaching aids that can be removed for duplication. (Author/MLB)

environmental education curriculum

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ENVIRONMENTAL EDUCATION PROJECT
ESEA TITLE III, SECTION 306

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A unit developed by the Environmental Education Project Staff, March, 1972, revised July, 1973, for Level II and III Educable Mentally Retarded Special Education classes.

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WATER

POLLUTION

The work presented or reported herein was performed pursuant to a grant from the United States Office of Education. However, the opinions and material expressed herein do not necessarily reflect the position or policy of the U. S. Office of Education, and no official endorsement by the U. S. Office of Education should be inferred.

Foreword

Water is one of the most polluted resources in our environment. Many of our clean rivers and lakes have been rendered unfit for man or wildlife as a result of dumping wastes into them. Businesses and private citizens must take it upon themselves to be concerned about this problem that threatens one of our most important natural resources.

Every person, regardless of their position in society, must help overcome this pollution problem. Everyone has the same basic need for pure water. It follows then that every person must have a knowledge of the causes, results, and solutions to the water pollution problem.

The amount of knowledge that can be absorbed and retained varies from person to person. This unit attempts to present information regarding water pollution on a level that can be usable for Level II and III educable mentally retarded students. There are four topics: 1) The Importance of Clean Water; 2) Some Sources of Water Pollution; 3) Effects of Water Pollution; and 4) Solutions to Water Pollution.

For each topic there are behavioral objectives, student activities, and teacher suggestions. The numbers in parentheses by the activity number indicate the objectives the activity helps develop. Teaching aids are located in the appendix. They can be removed for duplication.

A variety of activities are given for each objective. It is not expected that every activity will need to be used to achieve a specific objective. A variety of activities are included so teachers may select the activities that are appropriate for their class or an individual student. Teachers should feel free to modify or substitute activities to accomplish the objectives. Some objectives are more difficult than others. If a teacher wishes, she may select those objectives from the unit that best fit her class. Pretesting and posttesting should be done only with those objectives that are to be taught.

Thad L. Whiteaker

Thad Whiteaker
Program Specialist - Special Education

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The enclosed curriculum is the result of input from the project's paraprofessionals and volunteers, special education teachers, Community Council members, parents, students, and interested lay citizens.

With the deepest appreciation, I acknowledge the work of the secretarial team. The constant revisions, pressures, deadlines, and demands for quality work were handled in a most outstanding manner by Dorothy Booher, Sandy Holmes, Rita Dreiling and Peggy Ketter.

Donald French
Project Coordinator

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TABLE OF CONTENTS

Foreword ii

Acknowledgment iii

Table of Contents iv

Unit Goals and Objectives 1

Objective Summary Sheet 3

Unit Time Line 5

Materials Sheet 7

Topic I: The Importance of Clean Water 9

Topic II: Some Sources of Water Pollution 14

Topic III: Some Effects of Water Pollution 20

Topic IV: Some Solutions to Water Pollution 23

Appendix I: Clean Water Use Puzzle 30

Appendix II: The Story, "Big Trouble at Beaver Dam" 31

Appendix III: The Story, "The Dirty Bathwater" 36

Appendix IV: The Diagram, "Where Did the Water Go When I Drained the Bathtub?" 38

Appendix V: The Question Box 39

Appendix VI: Unit Related Audiovisual Materials 40

Appendix VII: Film Synopsis 41

Appendix VIII: Student Evaluation 42

Goals and Objectives

Goals: 1) To develop an understanding of some of the needs for clean water.

2) To understand some of the causes, effects, and solutions to water pollution.

Behavioral Objectives:

1) Given four choices, participating students will select "people and wildlife" as having the greatest need for clean water.

2) Given the statement "the main reasons that people need clean water are for recreation and personal health" participating students will indicate that this is a true statement.

3) Given four choices, participating students will select "60 gallons" as the average amount of water a person uses at home each day in America.

4) Given a multiple-choice question, participating students will indicate that factories and cities are two of the main polluters of streams and lakes.

5) Given four choices, participating students will select "feedlots" as a possible polluter of streams in Kansas.

6) Given the statement "some water pollution is caused by nature" participating students will indicate that this is a true statement.

7) Given four uses of untreated water, participating students will select "drinking untreated water" as the use most likely to make people sick.

8) Given a choice of four activities, participating students will indicate that swimming would be the activity that would not be permitted around or in a badly polluted lake.

9) Given four choices, participating students will select "fish" as the thing that would be harmed the most by the dumping of untreated sewage into streams and lakes.

10) Given four choices, participating students will indicate that water treatment plants are the method by which most cities clean water to be used in homes and businesses.

11) When given the statement "all cities and towns have waste water treatment plants" participating students will indicate that this statement is false.

12) When given the statement "the water treatment plant adds lime, carbon, soda ash, alum, fluoride, and_____ to the water to purify it" participating students will select "chlorine" from a list of four choices as the other chemical used.

13) Given a multiple-choice question, participating students will indicate that all water used by factories and cities should be put through waste water treatment before being returned to a stream or lake.

14) Given four choices, participating students will select "sand" as the material used in the filter at the water treatment plant.

15) Given four choices, participating students will select "primary treatment" as the process that removes most heavy, solid materials from waste water.

16) Given four choices, participating students will select "chlorine" as the chemical that the water treatment plant puts into the water to kill harmful germs.

17) Given four choices, participating students will indicate that bacteria are a part of secondary treatment at the waste water treatment plant.

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Objective Summary Sheet

Objective Number	Concept Within the Objective	Test Question Number	Class Pretest Results	Class Posttest Results
1	People and wildlife have a great need for clean water.	1		
2	Recreation and personal health create the greatest demand for clean water for people.	2		
3	The average American uses 60 gallons of water for home use each day.	3		
4	Factories and cities are the major polluters of water.	4		
5	Feedlots are a source of water pollution.	5		
6	Nature causes some water pollution.	6		
7	Drinking untreated water can make people ill.	7		
8	Some water becomes so polluted that people should not even swim in it.	8		
9	Fish can be harmed by dumping untreated sewage into lakes and streams.	9		
10	Most cities use water treatment plants to clean their water.	10		
11	All cities and towns do not have waste water treatment plants.	11		
12	The names of the chemical added to water at the water treatment plant.	12		
13	Factories as well as cities should treat all sewage before dumping it back into the lakes or streams.	13		
14	Sand is used to filter water at the water treatment plant.	14		

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Objective Summary Sheet (Continued)

Objective Number	Concept Within the Objective	Test Question Number	Class Pretest Results	Class Posttest Results
15	Primary waste water treatment removes heavy solids from the sewage.	15	_____	_____
16	Chlorine is put into the water at the water treatment plant to kill harmful germs.	16	_____	_____
17	Bacteria are a part of the secondary waste water treatment.	17	_____	_____

Unit Time Line

DAY	
	Before the trip:
X	Administer unit pretest.
	Duplicate Appendix I.
	Schedule the films Wild River and Birth of a River.
	Obtain one one-gallon water container for Activity 4.
	Call the Environmental Education office for copies of the booklet, The Story of Water Supply.
	Obtain words and music to river songs if Activity 6 is to be used.
	Begin study of unit.
	Determine a field trip date.
14	Submit field trip request to building principal. Check to see that all requirements for notification of parents have been fulfilled.
7	Meet with those helping with the trip to go over field trip details.
	Call the Environmental Education Project office to schedule environmental pictures 8 and 9 to be used with Activities 9 and 11.
	Schedule all other films to be used with this unit.
	Get together materials (two large glass containers) for Activity 12.
	Call the Environmental Education office and schedule feedlot slides for Activity 14 and the microprojector if Activity 20 is to be used.
	Call the Environmental Education Project office to schedule waste water and water treatment slide series.
	Duplicate Appendix III for use with Activity 23.
	Duplicate Appendix IV for use with Activity 24.
	Call the Environmental Education Project office to schedule water treatment chemical display.
	Prepare questions for Activity 30.
1	Contact program specialist to affirm readiness for trip on the following day. Give students the instructions they will need to be fully prepared for the trip.
0	Field Trip

DAY

After the trip:

1 Begin follow-up study.

Activities 29 and 30 should begin very soon after the trip.

Complete study of the unit.

Administer unit posttest.

Fill out Teacher's Unit Evaluation and submit to program specialist.

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Materials Sheet

This materials list gives a preview of the materials that will be needed to effectively teach the unit. The list includes names and/or description of the activity needing material, number of the activity in the unit, page number of the activity, and a list of materials needed for the activity.

Activity	Unit Activity Number	Unit Page Number	Materials
Use of clean water puzzle.	2	10	Duplicates of Appendix I.
View film and discuss.	3	10	Film: Wild River.
Demonstration: How much water do we use each day?	4	10	One one-gallon container, one dishpan or similar container.
The Story of Water Supply.	5	11	Copies of The Story of Water Supply for the whole class.
River songs.	6	12	Words and music to "Shenandoah," "Roll on Columbia," or "On the Banks of the Wabash."
View film and discuss.	7	12	Film: Birth of a River.
The story: "Big Trouble at Beaver Dam."	8	13	A copy of Appendix II.
Water pollution discussion.	9	14	Environmental picture 8 from Environmental Education office.
View film and discuss.	10	15	Film: Lakes: Aging and Pollution.
Water pollution discussion.	11	15	Environmental picture 9 from Environmental Education office.
Water pollution demonstration.	12	16	Two aquariums or two large-mouth one-gallon jars, tap water, trash articles such as old cans, bottles, and cigarette butts, and two live goldfish.

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Materials Sheet (Continued)

Activity	Unit Activity Number	Unit Page Number	Materials
Feedlot slides.	14	13	Slide series on feedlots from Environmental Education office.
Art activities.	16	13	A general supply of art equipment suitable for group and individual work.
View film and discuss.	17	20	Film: Problems of Conservation: Our Natural Resources.
Water sampling.	18	20	Several small containers for collecting water samples and several shallow dishes.
Safe water demonstration.	19	21	Two drinking glasses, one piece of construction paper.
Pond water study.	20	21	One microprojector, pond water.
View film and discuss.	21	22	Film: Environment In Crisis: The Aging of Lakes.
Waste water treatment slide series.	22	23	Slides on waste water treatment.
Story: "The Dirty Bathwater."	23	24	Duplicates of Appendix III.
Where did the water go when I drained the bathtub?	24	24	Duplicates of Appendix IV.
Water treatment slide series.	25	25	Slides on water treatment.
A diagram of the water treatment process.	26	25	Copies of: The Story of Water Supply.
Water treatment chemical display.	27	26	Display board of water treatment chemicals.
The question box.	31	29	A large number of questions about water pollution.

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Behavioral Objectives:

1. Given four choices, participating students will select "people and wildlife" as having the greatest need for clean water.
2. Given the statement "The main reasons that people need clean water are for recreation and personal health" participating students will indicate that this is a true statement.
3. Given four choices, participating students will select "60 gallons" as the average amount of water a person uses at home each day in America.

Student Activities	Teacher Suggestions
1. (Objectives 1,2,3) Clean Water Discussion 1. Help your teacher list the various ways that people use water. 2. Help your teacher list the various ways that wildlife uses water. 3. Discuss each use of water to determine if it matters if the water is clean. Could the water be used if it is polluted?	1. (Objectives 1,2,3) Clean Water Discussion 1. First, make a caption on the chalkboard entitled "PEOPLE." 2. Invite the students to tell of the various ways people use water. Write each use on the board under "PEOPLE." 3. Next, make another caption on the board entitled "WILDLIFE." 4. Ask students to tell of the ways that wildlife uses water. Write each one on the board under "WILDLIFE." 5. Take each use listed under both captions and discuss it. 6. The discussion should center on "How important is it that the water be pure and clean for this use?" 7. Example: Water for drinking should be as free from harmful germs as possible, but, our use of water for recreation, such as boating, need not be so pure and clean.

Student Activities	Teacher Suggestions
2. (Objectives 1,2,3) Use for Clean Water Puzzle 1. Unscramble the words on the puzzle sheet. Put each word in its proper place in the puzzle. 2. The unscrambled words tell of needs that people and wildlife have for clean water.	2. (Objectives 1,2,3) Use for Clean Water Puzzle 1. Appendix I is a puzzle for the students to work. Instructions for using the puzzle are included. 2. The puzzle may be duplicated.
3. (Objectives 1-9) Film: Wild River 1. View and discuss the film. 2. How did people use the river when it was clean? 3. What changes occurred on the river and why did they occur? 4. Did the water look pure and clean? Would it be safe to drink?	3. (Objectives 1-9) Film: Wild River 1. This film is in the Topeka schools' Film Library. Schedule it through your own school's media center. 2. See Appendix VII for a synopsis of the film. 3. The first half of the film deals with the many ways that people and wildlife use a clean stream. 4. The last half of the film shows some of the sources of stream pollution.
4. (Objectives 1,2,3) Demonstration: How Much Water Do We Use Each Day? 1. Observing the one-gallon of water as a guide, discuss the amount of water your family uses each day at home. 2. How can you use less water each day?	4. (Objectives 1,2,3) Demonstration: How Much Water Do We Use Each Day? 1. Obtain a one-gallon container. 2. Fill the container with water. Explain that each person in the United States uses about sixty of these each day for home use. Home use would include cooking, washing clothes, bathroom uses, etc. 3. Pour one gallon of water into a large container such as a dishpan. Discuss the ways that one gallon of water would be used. Example: Brushing teeth, washing hands and face, etc.

Student Activities	Teacher Suggestions
	4. Discuss the amount of water used in bathing and flushing the toilet stool. 5. Have students discuss ways they could use less water each day. Example: Turn off water while brushing teeth.
5. (Objectives 1,2,3) The Story of Water Supply 1. Use this comic-style booklet to learn of the amount of water we use, the effects of drinking untreated water, how a water treatment plant cleans the water, and why we need clean water.	5. (Objectives 1,2,3) The Story of Water Supply 1. This booklet can be used as a source of information for some, or all, of your students. 2. Copies of this booklet can be obtained through your local water treatment plant. 3. The booklet is prepared and published by: American Water Works Association, 2 Park Avenue, New York, New York. 4. The Topeka Environmental Education Project will supply copies to local teachers. 5. Pages 2, 3, 7, 10, 11, 14, and 15 are applicable to this unit of study. 6. Each student working on this activity should have a copy of the booklet. 7. Page two shows how much water is used. Page three shows how it is used. Page seven tells of a few bad affects of using untreated drinking water. Pages 10 and 11 show water treatment procedures. Pages 14 and 15 tell of the many uses of clean water. 8. You might set aside study periods for each series of pages. Example: One day you might take the students through pages two and three. On another day, page seven. Pages 10 and 11 could be studied a few days before visiting the water treatment plant. Pages 14 and 15 could be covered as the last portion of the booklet.

Student Activities	Teacher Suggestions
6. (Objectives 1-9) River Songs 1. Learn the words to a song about a river and sing it. 2. Discuss the words to the song. Think about why the song writer wrote such a song.	6. (Objectives 1-9) River Songs 1. Bring to the class a song that describes a river or the mood it creates. 2. Some traditional songs of this nature are "Shenandoah," "Roll on, Columbia," and "On the Banks of the Wabash." 3. The music teacher may be able to help locate words and music or a record of such songs. 4. Have the class learn the song. Discuss the characteristics of the river that might have inspired the song writer. 5. Discuss the possibility of some of our polluted streams having a song written about them. 6. Ask the students if there has been a song written about our closest river - the Kansas River (KAW). 7. Maybe your class can write a song about water.
7. (Objectives 1-6) Film. <u>Birth of a River</u> 1. View the film and take part in a discussion following the film.	7. (Objectives 1-6) Film: <u>Birth of a River</u> 1. This film is in the Topeka schools' Film Library. Schedule it through your own school's media center. 2. See Appendix VII for a synopsis of the film. 3. The vocabulary is rather high in this film, but it can be used as a basis for discussing many aspects of water pollution. 4. This film shows a variety of recreational uses of water. Bring out that we also need clean water for recreation. 5. Natural pollution can be shown with this film. Flood scenes depict this. 6. After viewing the film, suggest that the students help you make a list of the many uses that people have for water. Write them on the board.

Teacher Suggestions

7. Go over the list one item at a time. If an activity listed can only be safely engaged in using clean water, circle it. Check to see how many uses are circled at the end of the activity.
8. Remember! Those water uses that are circled can only be done <u>safely</u> with clean water.

8. (Objectives 1-9)

The story: "Big Trouble at Beaver Dam"

1. Read this story individually or listen as the teacher reads it to the class.
2. Discuss the various pollution topics mentioned in the story.

8. (Objectives 1-9)

The story: "Big Trouble at Beaver Dam"

1. This story is taken from the July, 1970, issue of Ranger Rick magazine. Ranger Rick is published by the National Wildlife Federation.
2. A copy of the story is provided in Appendix II. Read the story to the class.
3. Point out that the poisoned water caused the beavers to be sick.
4. Point out that the same kind of water could cause people to be sick if they drank or swam in it.
5. Emphasize that people caused the water to become polluted.

TOPIC II: Some Sources of Water Pollution

Behavioral Objectives:

4. Given a multiple-choice question, participating students will indicate that factories and cities are two of the main polluters of streams and lakes.

5. Given four choices, participating students will select "feedlots" as a possible polluter of streams in Kansas.

6. Given the statement "some water pollution is caused by nature" participating students will indicate that this is a true statement.

Student Activities	Teacher Suggestions
9. (Objectives 4,5,6) Water Pollution Discussion 1. Study the large picture depicting a source of water pollution entering a stream. 2. Exchange ideas with the class regarding what the picture shows. 3. What are other means of water pollution? Is man responsible for all of them?	9. (Objectives 4,5,6) Water Pollution Discussion 1. To begin a discussion of water pollution sources, obtain picture 8, developed by the Silver Burdett Company, from the Environmental Education picture packet. 2. Picture 8 will be furnished to local teachers by the Topeka Environmental Education Project. 3. Set the picture up in a prominent place in the classroom. 4. Give the students ample time to look it over and form some opinions before beginning a discussion. 5. Ask students to give their ideas about what the pictures show. 6. With this picture as a stimulus, emphasize that the two main causes of water pollution are chemical waste from factories and sewage. 7. Emphasize that water pollution can be very dangerous; it can kill fish and cause the spread of diseases in people. 8. Lead into other sources of water pollution by asking the students to help you make a list of all causes of water pollution.

Student Activities	Teacher Suggestions
10. (Objectives 1-13) Film: Lakes: Aging and Pollution View the film and discuss what the film showed regarding water pollution.	10. (Objectives 1-13) Film: Lakes: Aging and Pollution 1. This film is in the Topeka schools' film Library. Schedule it through your own school's media center. 2. See Appendix VII for a synopsis of the film. 3. This film can help meet many of the objectives from one through thirteen. However, Objective 5 should be specifically emphasized with this film. 4. Stop the film on the feedlot scene. Discuss feedlots and how they might cause water pollution. 5. Emphasize, too, that factories and cities are the main source of water pollution. Factories dump chemical wastes into streams and lakes; cities dump sewage into bodies of water.
11. (Objectives 4,5,6) Water Pollution Discussion 1. View a large aerial picture showing waste flowing downstream. 2. Exchange ideas with the class regarding what the picture shows.	11. (Objectives 4,5,6) Water Pollution Discussion 1. To begin another discussion on water pollution sources, obtain picture 9 of the Environmental Education packet. 2. Set the picture up in a prominent place in the classroom. 3. Give the students ample time to look it over and form some opinions before beginning a discussion. 4. A teacher's manual will accompany the picture. Use the manual to develop questions to discuss. 5. Picture 9 is an aerial shot of waste flowing downstream. 6. Discuss the ways that the pollution might have gotten into the stream. 7. Emphasize that runoff from cattle feedlots could cause pollution in streams such as the one shown in picture 9.

Student Activities	Teacher Suggestions
12. (Objectives 4-9) Water Pollution Demonstration 1. Help the teacher set up and complete a demonstration to show: 1) causes of water pollution, and 2) effects of water pollution.	12. (Objectives 4-9) Water Pollution Demonstration 1. This activity is designed primarily to show: 1) how water becomes polluted, 2) effects of polluted water on fish, and 3) to contrast polluted water and clean water. 2. You will need two glass containers. Aquariums are great, however, large-mouth gallon jars will do fine. 3. You may want to use goldfish in this demonstration to show the effects of polluted versus nonpolluted water. 4. Fill both containers with water from the faucet. Impress upon the students that this is treated water and is perfectly healthy for people and wildlife to use. 5. Put a goldfish in each of the containers of water. Since the water has been chemically treated, you may need to put something into the water to counteract those chemicals or let the water stand for 24 hours. 6. Emphasize the goldfish should be able to live in this water for a time. 7. Have the students bring trash, such as empty vegetable cans, pop cans, cigarette butts, etc. to put into one container of water. Do not clean any of these items before putting them in the water. This is the pollution example. It merely shows the usual things that careless people throw into our lakes and streams. 8. Put nothing into the other container except a small amount of fish food. 9. Make daily observations of both containers of water. Be especially careful to observe the changes that take place in the "trashy" water. It might be wise to keep a daily record of the observations.

Student Activities	Teacher Suggestions
	10. The goldfish in the "trashy" water will probably die in a short while so if the students are not prepared for this do not use a goldfish in this container of water. Instead, you might discuss what might happen to the fish were it in the water.
13. (Objective 5) Feedlot Discussion Discuss the following topics: 1) What is a feedlot? 2) Where are feedlots found? 3) Are feedlots a cause of water pollution?	13. (Objective 5) Feedlot Discussion 1. This activity is necessary in order to achieve Objective 5. 2. The purpose is to acquaint the class with: 1) What are feedlots; 2) Where are they found? 3) Are they a cause of water pollution? 4) Do all feedlots pollute? 3. This discussion will center around the body waste of hundreds of animals concentrated in one spot. 4. Point out that humans produce as much, or more, body waste as animals, however, most human waste is treated before it is sent to a stream. Animal waste is not usually treated. 5. Point out that after animal waste is deposited on the ground, unless the feedlot operator has made special efforts to control it, especially when it rains, most of it gets into streams. 6. Point out that feedlots have become a special concern of water pollution in Kansas because Kansas farmers raise and feed a lot of cattle. 7. Emphasize that recently laws have been made for feedlot operators to follow in operating a feedlot. These laws are set forth to ensure that the feedlot does not pollute streams to a great degree. 8. If possible, get a picture of a feedlot and post it in a prominent place in the classroom.

Student Activities	Teacher Suggestions
14. (Objective 5) Feedlot Slides 1. View a series of slides on feedlots. 2. Discuss with the class and teacher how feedlots could be a source of water pollution.	14. (Objective 5) Feedlot Slides 1. This activity is necessary in order to achieve objective 5. 2. A short series of slides showing feedlots are available from the Environmental Education office. Call well in advance of the time you wish to use them. 3. These slides are coordinated with a tape that: 1) defines the term "feedlot"; 2) explains why we are concerned about feedlots as polluters of water, 3) the reasons for having feedlots; and 4) recent regulations on feedlots.
15. (Objectives 4,7,9) Letters to Factories Help write a letter to a factory to find out how they use water.	15. (Objectives 4,7,9) Letters to Factories 1. Assist the students in preparing a letter to one, or several, factories in your area. In Topeka, some factories are: 1) Kansas Power and Light; 2) Du Pont Company; and 3) Goodyear Tire and Rubber Company. 2. Some questions to pose in the letter would be: 1) Do you use water in making your product? 2) If you do use water, where does it come from? 3) After using the water, where does it go? 4) Do you treat the water before you send it back to where you got it? Does it need treatment? Why or why not?
16. (Objectives 1-17) Art Activities Draw pictures showing: 1) why we need clean water; 2) how water becomes polluted; 3) the harm caused by polluted water; and 4) how we can help keep our streams and lakes clean.	16. (Objectives 1-17) Art Activities 1. This activity can reinforce practically every objective. 2. Art activities might work best following a movie, slides, or discussion on the particular part of water pollution you wish to cover. Example: if you are interested in

Student Activities	Teacher Suggestions
	sources of water pollution, follow-up a movie or discussion on sources of water pollution with art work showing the students' understanding of such sources. 3. Each student should be encouraged to draw his version of the topic studied. 4. The whole class could work out a mural on water pollution. The mural could show: 1) the need for clean water; 2) causes of water pollution; 3) effects of water pollution; and 4) some solutions to water pollution problems.

TOPIC III: Some Effects of Water Pollution

Behavioral Objectives:

7. Given four uses of untreated water, participating students will select "drinking untreated water" as the use most likely to make people sick.

8. Given a choice of four activities, participating students will indicate that swimming would be the activity that would not be permitted around or in a badly polluted lake.

9. Given four choices, participating students will select "fish" as the thing that would be harmed the most by the dumping of untreated sewage into streams and lakes.

Student Activities	Teacher Suggestions
17. (Objectives 4-9) Film: <u>Problems of Conservation: Our Natural Resources</u> View the film and discuss water pollution scenes shown in the film.	17. (Objectives 4-9) Film: <u>Problems of Conservation: Our Natural Resources</u> 1. This film is in the Topeka schools' Film Library. Schedule it through your own school's media center. 2. See Appendix VII for a synopsis of the film. 3. This film has some very good water pollution scenes. 4. Causes and effects of water pollution can be emphasized. 5. This film deals with pollution in general. Preview it and plan on stopping at the water scenes.
18. (Objectives 4-9) Water Sampling Collect water samples from different places. Study them to determine causes of pollution.	18. (Objectives 4-9) Water Sampling 1. Have the students collect samples of water from different places. Streams, ponds, puddles, and gutters are good sources for collecting. 2. Shake up the samples and place a teaspoon of each in a separate dish. Let the samples evaporate. After the water evaporates, there will probably be a residue of some sort in each dish. 3. Examine the residue and discuss: 1) how it got there; 2) is it harmful; and 3) could this water be made safe to use.

Student Activities	Teacher Suggestions
	4. Be sure to review Objectives 7, 8, and 9 before using this activity.
19. (Objectives 4-9) Safe Water Demonstration Take part in a demonstration of safe and unhealthy water.	19. (Objectives 4-9) Safe Water Demonstration 1. This demonstration should emphasize the need for clean water and some causes of water pollution. 2. You will need two containers of water. One should be clean water from your classroom water faucet. The second should be dirty water. You can get it from a pond or any source that would be considered at least unsafe for drinking. 3. Display the glass of water from the faucet. Ask the students if they think it is safe to drink. Explain the process of making water safe for drinking. Has the water been used before? Where did it come from? 4. Display the dirty water with this sign: "Danger In Your Drinking Water." Ask the students what the sign means. What may have happened to cause the water to be dangerous? Ask about different ways that water becomes polluted. 5. Be sure to review Objectives 7, 8, and 9 before using this activity.
20. (Objectives 1-9) Pond Water Study 1. Observe pond water using the microprojector. 2. Discuss observations with the teacher and members of the class.	20. (Objectives 1-9) Pond Water Study 1. Bring some pond water to class. Allow the students to examine it using a microprojector. 2. Let the students see that the sample of pond water contains moving organisms. 3. Lead into a discussion centered around the fact that all water is not safe for drinking or, in many cases, recreational uses. Emphasize that even though water looks safe, it may take a microscope to see germs in the water that would make it unsafe.

Student Activities	Teacher Suggestions
	4. Listed here are some questions that would be appropriate for this activity. 1) Who is responsible for what happens to water after it falls to the ground? 2) Why is some of our water not fit to use? 3) Why does our water, which gives us life, also sometimes cause illness and death? 5. A microprojector may be obtained from the Environmental Education Project office or from any elementary school.
21. (Objectives 1-9) Film: <u>Environment In Crisis: The Aging of Lakes</u> View the film and discuss pollution topics shown in the film.	21. (Objectives 1-9) Film: <u>Environment In Crisis: The Aging of Lakes</u> 1. This film is in the Topeka schools' Film Library. Schedule it through your own school's media center. 2. See Appendix VII for a synopsis of the film. 3. This film has a high vocabulary. Preview the film before showing it to your class. 4. A variety of water pollution sources is shown. 5. There are some excellent scenes showing the effects of water pollution, such as "No Swimming" signs, fish kills, etc. 6. Note the scenes that emphasize factories and city sewage--the prime polluters of water.

TOPIC IV: Some Solutions to Water Pollution

Behavioral Objectives:

10. Given four choices, participating students will indicate that water treatment plants are the method by which most cities clean water to be used in homes and businesses.

11. When given the statement "all cities and towns have waste water treatment plants" participating students will indicate that this statement is false.

12. When given the statement "the water treatment plant adds lime, carbon, soda ash, alum, fluoride, and _____to the water to purify it" participating students will select "chlorine" from a list of four choices as the other chemical used.

13. Given a multiple-choice question, participating students will indicate that all water used by factories and cities should be put through waste water treatment before being returned to a stream or lake.

14. Given four choices, participating students will select "sand" as the material used in the filter at the water treatment plant.

15. Given four choices, participating students will select "primary treatment" as the process that removes most heavy, solid materials from waste water.

16. Given four choices, participating students will select "chlorine" as the chemical that the water treatment plant puts into the water to kill harmful germs.

17. Given four choices, participating students will indicate that bacteria are a part of secondary treatment at the waste water treatment plant.

Student Activities	Teacher Suggestions
22. (Objectives 10,11,13,15,17) Waste Water Treatment Slide Series 1. View slides of the waste water treatment process. 2. Discuss the terms: primary treatment, secondary treatment, and bacteria.	22. (Objectives 10,11,13,15,17) Waste Water Treatment Slide Series 1. Call the Environmental Education Project office well in advance to schedule the slide series. 2. Check the objectives listed above. These slides will help achieve each one listed for this activity.

Student Activities	Teacher Suggestions
	3. The slides show a sequential approach used in treating sewage before it is dumped back into the river. 4. Be sure to use the terminology, ie, "primary treatment" and "secondary treatment" at the appropriate times so that the students may become familiar with them. 5. Explain what the terms "settling tank" and "bacteria" mean.
23. (Objectives 1,2,4,7,8,9,11,13,15,17) The story: "The Dirty Bathwater" 1. Read or listen to the story of "The Dirty Bathwater." 2. Discuss the path dirty water takes from homes to a river. 3. Fill in the blank spaces in a paper supplied by the teacher. This paper tells the name of each step in waste water treatment.	23. (Objectives 1,2,4,7,8,9,11,13,15,17) The story: "The Dirty Bathwater" 1. Appendix III contains the story of the trip dirty bathwater takes on its way to the river. 2. You may duplicate this story so that each student can have a copy. 3. You may choose to read the story to the class. 4. After you introduce the story to the class (or after they have read it), have the students fill in the blanks from Appendix IV in Activity 24. 5. You may want the students to work on Activity 24 as you read this story.
24. (Objectives 10,11,13,15,17) Where Did The Water Go When I Drained the Bathtub? Follow the path of dirty water from a bathtub to a river by filling in blank spaces with the proper words.	24. (Objectives 10,11,13,15,17) Where Did The Water Go When I Drained the Bathtub? 1. Review the objectives listed above. This activity will help achieve each one. 2. See Appendix IV for a diagram showing the path waste water takes from a bathtub to a river. 3. Each step of the path the dirty water takes from the bathtub to the river is numbered and has a blank space by the number. 4. The students should use the words in Appendix IV to fill in the blank spaces. For example: The words "dirty bathwater" should go in the blank numbered one.

Student Activities	Teacher Suggestions
25. (Objectives 10,12,14,16) Water Treatment Slide Series View and discuss slides of the water treatment process.	25. (Objectives 10,12,14,16) Water Treatment Slide Series 1. Check the objectives listed above. These slides will help achieve each one. 2. Call the Environmental Education office to schedule the series. Do this well in advance of the date you wish to use them. 3. This slide series shows and explains the process of taking water from the river and cleaning it up to be used in homes throughout the city. 4. A taped narration goes with the slides. Preview the series before using it with your class. Each process is explained and you will need to be familiar with the series in order to discuss it with your class.
26. (Objectives 10,12,14,16) From River To Home - A Diagram of the Water Treatment Process Follow the diagram as it traces each step water goes through in going from river to homes.	26. (Objectives 10,12,14,16) From River To Home - A Diagram of Water Treatment 1. Review the objectives listed above. This activity will help achieve each one. 2. If you did Activity 5, you should already have copies of <u>The Story of Water Supply</u>. If you need copies, call the Environmental Education office. Each student should have a copy. 3. Pages 9 through 11 show and explain the processes by which water is made safe for use. 4. Read through the diagram with the students. 5. After tracing the treatment process from river to home, discuss each step of the treatment process. 6. Be sure to cover these points: 1) the chemicals that are used in water treatment; 2) the mechanical mixing basins; 3) the sedimentation tanks; and 4) the filters.

Student Activities	Teacher Suggestions
27. (Objectives 10,12,14,16) A Display of Chemicals Used in Water Treatment View and discuss the display of chemicals used in the water treatment process.	27. (Objectives 10,12,14,16) A Display of Chemicals Used in Water Treatment 1. This activity will be especially helpful in achieving Objectives 12, 14, and 16. 2. Samples of lime, carbon, alum, and soda ash are mounted on a sample board for you to display and discuss with the class. Each sample has a written explanation as to why it is used. 3. Since chlorine and fluoride can be dangerous, no samples of these two chemicals are furnished. However, the sample board does have spaces with their names along with an explanation as to how and why they are used. 4. Be sure to explain thoroughly that chlorine used properly kills harmful germs in the water. 5. The Environmental Education Project will supply the sample display when requested.
28. (Objectives 11,13,15,17) Observe the steps included in waste water treatment.	28. (Objectives 11,13,15,17) Field Trip - Waste Water Treatment Plant 1. A tour of the waste water treatment plant will be conducted by the program specialist and personnel of the plant. 2. During the tour, the following processes will be pointed out and explained. A. Primary Treatment 1) Screen - removes heavy, solid objects from sewage. 2) Grit Settling Tank - water flow slows down and lets sand and grit settle to the bottom. 3) Primary Settling Tanks - the water is held in tanks. The heavier material settles to the bottom. It is called sludge. Grease rises to the top and is scraped off by a big paddle.

Student Activities

Teacher Suggestions

4) Sludge Pumps - pumps the sludge from the settling tanks to the digester.

B. Secondary Treatment
1) Aeriation Tanks - bacteria are mixed with the sewage water. They eat the remaining sewage that the water contains.
2) Settling Tank - The bacteria (full of sewage) settle to the bottom. The clean water is pumped into the river. The bacteria are pumped back to the aeriation tank to be used again.

C. The Digesters
1) Sludge is pumped to the digesters. Bacteria work on the sludge turning part of it into gas. The gas is used to run the big engines at the plant. The remaining sludge is put out in the open to dry. It is hauled off to a place for disposal. It can be used to fertilize gardens and farmland.

29. (Objectives 10,12,14,16)

Visit the water treatment plant.

29. (Objectives 10,12,14,16)

Field Trip - Water Treatment Plant

1. A tour of the water treatment plant will be conducted by the program specialist and personnel of the plant.
2. During the tour, the following processes will be pointed out and explained.
   1) The Laboratory - various tests are conducted to determine the cleanliness and purity of the water.
   2) Mixing Room - alum, soda ash, lime, and carbon are mixed with water. The solution is then pumped to the water just before it goes into the settling tank.
   3) Chlorine Room - the chlorine is put into the water in a special room. Chlorine gas would be very harmful to anyone breathing it. Mixed with water, it kills germs.

Student Activities

Teacher Suggestions

4) Fluoride - Fluoride is mixed with the water in many cities, as in Topeka, to help prevent tooth decay. Fluoride can be poisonous if not mixed with the water in the correct amount.
5) Intake Pump - Water is pumped from the river. It first goes through a screen to remove large objects such as sticks and fish.
6) Settling Tanks - These consist of a series of tanks where the water is held in large basins so that the chemicals may do their job of removing mud from the water, removing bad odor, and softening the water.
7) Sand Filter Tank - This is the last process the water goes through before it goes out to homes, factories, and businesses in the city. The water comes into these tanks, the bottoms of which are filled with a six-inch layer of sand. The water filters down through the sand removing any remaining particles of mud.

30. (Objectives 10-17)

Waste Water - Water Treatment Plant Discussion

Discuss the various things observed at the waste water and water treatment plants.

30. (Objectives 10-17)

Waste Water - Water Treatment Plant Discussion

1. Initiate a discussion on the visits to the waste water and water treatment plants.
2. The purpose of this activity is to answer questions that might have been brought about by the visit.
3. This would be a good time to review some of the activities that your class did just prior to visiting the treatment plants.
4. Consider showing the slide series for the waste water and water treatment plants again.

Student Activities	Teacher Suggestions
31. (Objectives 1-17) The Question Box Select questions from the question box. Read the question for the other students, or group, to answer.	31. (Objectives 1-17) The Question Box 1. Prepare a number of questions relating to: 1) Why we need clean water; 2) Causes of water pollution; 3) Effects of water pollution; and 4) Solutions to water pollution problems. (See Appendix V for sample questions.) 2. Put each question on a small piece of paper. 3. Put each question into a large covered box. Leave a hole in the box large enough for a hand to reach into it. 4. You may choose to let one student reach into the box and select a question to ask the class as a whole. 5. You may choose to divide the class into different teams and have a contest.

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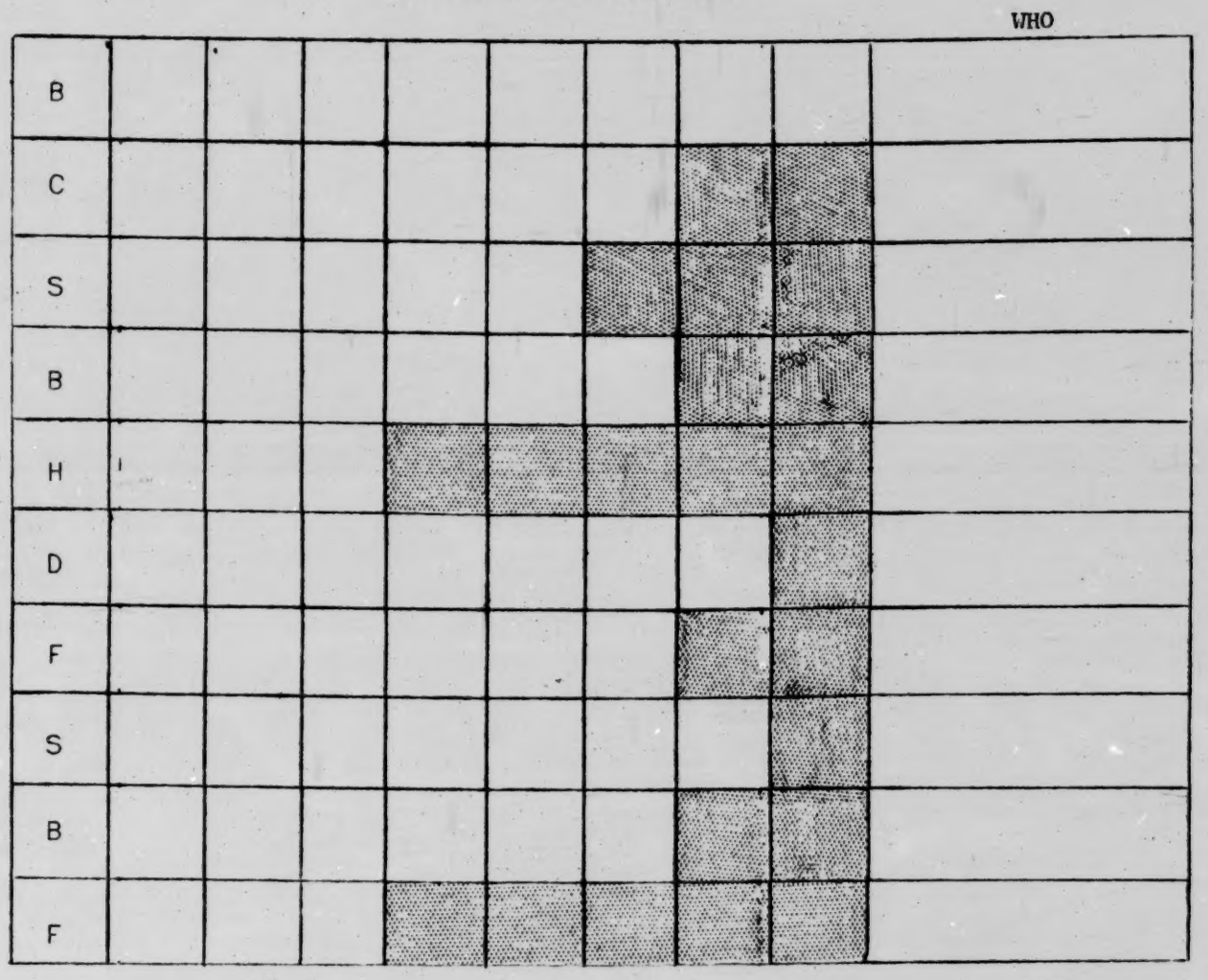
APPENDIX I

Clean Water Use Puzzle



OKOCGIN	SWMMGNII	RDGNIKNI	TAOBNGI	SGHNFII
EHMO	HTAEBRNIG	GNIBTHA	IGNISK	DOFO

1. Each scrambled word fits into one of the lines above.

2. Each word represents a use or need that people and/or wildlife have for water.

3. The first letter of each word has been placed in the first block to aid in getting the proper word. There is one block for each letter of the word.

4. The last column labeled "WHO" is to be used to identify who uses (or needs) the water in the particular way that the word describes. Example: If you had the word "FOOD" then you would write "people and wildlife" in the "WHO" column.

APPENDIX II
Big Trouble at Beaver Dam
By Sara Bulette
Ranger Rick, July, 1970

Rick, curled up on a low branch of the big oak tree, was watching Ollie Otter finish a new mud slide. It was near the entrance to Terry Turtle's cave, where Rick's Rangers had their headquarters.

Even in the shelter of the tree, Rick could feel the heat of the summer morning sun. Today was going to be a scorcher. He hoped the Rangers would be on time for the meeting. Then they would have all afternoon to rest and play in Shady Pond.

Ollie, poised at the top of his slide, called softly to Rick. "Here comes Cubby Bear. Watch this." Then he yelled, "Cubby! come quick! You've got to see this!"

Cubby went down on all fours and charged toward Ollie, braking at the last minute. Ollie jumped aside and Cubby plunged headfirst, sliding right down on his belly.

"Wish I could make a splash as big as that," sang Ollie as he ran for a tree.

Cubby clawed his way up the bank, growling with rage. From behind the tree, Ollie called, "Thanks a lot! You really put the finishing touches on my slide." Then he made a dive for the water.

"Don't pay any attention to him, Cubby. He can't stand being ignored," said Rick. "Here comes Davey Deer with most of the others. We can start the meeting." He scampered down the tree and up on a stump.

Bluey Jay flew to his lookout post at the top of the big oak and the others gathered around Rick. Ollie sneaked out of the pond and sat close to his slide.

"Looks as though we're all here except Billy Beaver," said Rick.

"Billy can't make it today," reported Sammy Squirrel. "He told me to tell you the kits are sick and he's trying to find out what they've been eating."

"That's a shame," said Rick. "Nurse Zelda Possum and I had better go over there after the meeting to see if we can help."

Ollie decided not to wait. He eased himself onto his slide and was soon swimming down toward Billy's dam on Clear Creek. The meeting was almost over when he got back. He was carrying a dead fish, which he tossed on the ground with a flourish.

Appendix II
Big Trouble at Beaver Dam (Continued)

"Is that a present for me, to make up for my ducking?" grinned Cubby.

Don't dare touch it!" cried Ollie. "It's probably poisoned."

Rick looked at him sternly. "If this is another one of your jokes it isn't very funny."

"There's trouble at the beaver dam, Rangers," said Ollie, ignoring Rick. "This wasn't the only dead fish I saw, and Billy's kits are <u>really</u> sick."

All the Rangers began chattering at once. Rick jumped onto his tree stump. "Quiet, everybody! Ollie sure isn't joking this time. There must be something bad in the water. We've got to make a plan--and fast. Think of all the animals that live in that dam!"

"Muskrats, frogs, ducks, watersnakes," wailed Zelda. Then Rick cut her off. "Frances Flicker," he said, "you must fly down and tell Billy Beaver to meet us on the side of the dam near Old Swamp Road. Tell all the others to come to Shady Pond. They'll be safe here because it's upstream."

Then he turned to Nurse Zelda. "Start setting up a hospital in Terry's cave. Terry and Ollie can help you. Odora Skunk and Pudgy Porcupine can take turns on guard duty in case Wally Wolf sniffs out the fact that we're in trouble."

"He has!" screeched Bluey Jay. "I just saw him dodge behind a tree."

"Come with me, Cubby," said Rick. Stiff as a poker, he marched into the woods, then stopped and yelled, "<u>Now hear this</u>, <u>Wally</u>! There's something wrong with the water in beaver dam. It could ruin Clear Creek. You need that creek as much as we do. If you can't help us, at least don't keep us from doing our job."

Out into the woodpath stepped Wally. Slowly, carrying his bushy tail like a flag, he walked away.

"I'm going after him," said Cubby. "The way he pokes his nose into everything, he just may be able to give us a clue as to where to start looking for the trouble."

"Good luck," said Rick. "I guess Wally wouldn't try to tackle <u>you</u>." Then he turned back to the others. "Davey, Sammy Squirrel and Chester Chipmunk, get down to where we said we'd meet Billy. Don't wait for me. I'll follow as fast as I can."

Davey looked nervous. "Maybe we should stick together. Wally might circle back and jump you."

"I don't think so," said Rick, trying to sound as though he believed it.

Davey leaped over a low bush, and Sammy and Chester took to the trees. Soon they were out of sight. Rick scrambled along as fast as he could, keeping a sharp watch in all directions. Then came a crashing in the underbrush and the welcome sound of Cubby's deep voice. "Wait for me!"

As soon as he caught up, he gave Rick the good news. "Wally did see something last night. Two men in a truck pulled off Old Swamp Road where it comes close to the edge of the marsh above Billy's dam. They had a mean dog with them so Wally didn't go too close. He doesn't really know what they did."

"Dumped something, maybe," said Rick. "We're near that spot now."

Rick was the first to see tiremarks on the shoulder of the road. Cubby found footprints leading into a stand of cattails that edged the marsh. Plowing through them, he slipped in the mud. By the time Rick reached him, he was sitting up in shallow water rubbing his head. "I sure hit something hard," he said.

"Get out of there!" cried Rick. "The stuff they dumped could be near you."

As he struggled to his feet Cubby gave a cry of surprise. "Here's what I hit my head on! They look like oil drums."

Just then Bluey Jay landed near them. "I stayed with you till you and Cubby found the marks. Then I flew and told the others at the dam. They're on their way here."

"Good work, Bluey!" said Rick. "There's Davey Deer now. And boy, do I need him."

"Why?" grumbled Cubby. "I could get those drums out of there without any help."

"We're not going to touch them," replied Rick. "I have a feeling Ranger Tom should handle this. Davey can take me to him fast.

A silver moon sailed high above Shady Pond when Davey Deer trotted down the woodpath toward Terry's cave, with Rick clinging sleepily to his back. Pudgy Porcupine, taking his turn on guard duty, had good news for them. The kits were better and no one else was sick. But Shady Pond was crowded with animals from Billy's dam. Some of them thought the whole thing was pretty silly and wanted to go home.

Appendix II
Big Trouble at Beaver Dam (Continued)

"They can go back tomorrow," Rick announced. "The poison in those drums did not have a chance to get into the dam. The beaver kits and the fish that died must have poked their noses right into them."

"Did you say poison?" exclaimed Cubby.

"Yes, I said poison. Those drums didn't have oil in them--though that would have been bad enough. They were once filled with a powerful spray to kill insects."

"How do you know?" asked Pudgy.

"Ranger Tom found it out when he took the drums back to his headquarters," replied Rick. "There was enough of the stuff left in them for him to tell, even though the labels had been taken off the drums.

"But the best part," Rick went on, "was that the drums were stuffed with old magazines. Tom could read the address stickers on some of them. That led him to a farmer on Old Swamp Road.

"The man got the drums at a junkyard and planned to use them to float a raft on his farm pond. He had a few drums left over and a bunch of old magazines he wanted to get rid of. So he stuffed them in the drums and sank them in the marsh, 'killing two birds with one stone,' as he said to Ranger Tom."

"Could have been a lot more than two birds," grumbled Cubby.

"He knows that now!" exclaimed Rick.

"Did Tom tell the man about us?" asked a horrified Cubby.

"Of course not!" Rick answered. "Ranger Tom told him he was lucky he hadn't put the raft in the pond yet. If he had, a lot of his fish might have died. And it wouldn't be too good for the people who swim there. Chances are, he'd never have known why."

"Wouldn't he be surprised if he knew he owed his escape to a wolf?" chuckled Cubby.

"For that matter, so do we," smiled Rick.

Appendix II
Big Trouble at Beaver Dam (Continued)

"Oh, I forgot to tell you," said Cubby. "I thanked Wally when he gave me that tip. He said not to waste time being grateful, just to get on with our job so he could do his."

"That figures," said Rick with a tired grin. "But it's been a hard day. Let's get some sleep. Just be sure someone is on guard duty!"

THE END

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APPENDIX III

The Dirty Bathwater

Hi! I'm your dirty bathwater. Would you like to hear about me? I've just cleaned up the dirtiest boy in town.

I don't mind getting dirty when I help, but I sure don't like to stay dirty. If I stay dirty it makes me smell bad and look funny. If I stay dirty the rivers, lakes and oceans won't be so good for fish or boats or for swimming at sandy beaches. If I stay dirty I might carry germs and make people sick and that is something water doesn't want to do.

I'm glad to tell you my city has a place to clean dirty water. It's called a waste water treatment plant. Would you like to hear about it? OK, I'll tell you.

When I finished cleaning up this dirty boy, I slid down the drain with all the dirt I was carrying. I ran through some pipes in the ground called sewers. As water runs fast, it can carry more dirt, so the sewers are built going downhill to make it easier for me to run.

Sometimes the sewers get too deep and I can't go downhill anymore. When that happened to me, I went through a pump. The pump spun me around and around like a carnival ride until I was dizzy. Then, like an elevator, it pushed me up high so I could run downhill again.

The sewers are like streets for us and I followed them right to the waste water treatment plant.

A waste water treatment plant is like a factory with pumps, pipes, valves, motors, machines and big tanks, all needed to make dirty water clean.

At the plant in my city, I started by going through some bars called a screen. The screen caught sticks, pieces of paper, and rags that is carried by most dirty water.

After the screen I went into a tank that made me slow down a bit. Remember, I said that when dirty water runs fast it can carry more dirt. When I slowed down a bit, I had to drop some of the heavy pieces of dirt, called grit, and let them fall to the bottom of the tank. Can you guess why this tank is called a grit tank?

Next, I went into a big tank that made me go ever so slow. I almost went to sleep going so slow, but it made me drop all kinds of dirt. The dirt that I dropped here is called sludge. Making me go slow to drop the dirt is called sedimentation or settling. Can you guess what this tank is called? That's right, it's called a sedimentation tank. The sedimentation tank has equipment in it to take out the sludge.

Appendix III
The Dirty Bathwater

When I came out of the sedimentation tank, I was through with what is called primary treatment. I was feeling quite a bit better, but not nearly as clean as I should be.

Some dirt really sticks to a fellow. You know how sometimes you have to scrub hard to get clean. Well, I still needed a good scrubbing. You use a wash cloth to scrub with, but dirty water is scrubbed by a lot of helpful little fellows called bacteria. The bacteria are so small that you can't see them without special help. The bacteria didn't scrub me with a cloth or brush but they did clean off the dirt that I couldn't drop by myself. That dirt was their food. They gobbled it up and got fat while I got clean.

The cleaning by the bacteria is called secondary, or second step, treatment.

There are two ways that bacteria are kept in a waste water treatment plant. One is called activated sludge and the other is called trickling filter.

In the Topeka waste water treatment plant the bacteria are kept in activated sludge. In activated sludge, the bacteria float around with us in a big tank called an aeration tank. The aeration tank has air bubbling through it to keep us all mixed together and to give oxygen to the bacteria. I liked the aeration tank. Those bubbles kind of tickled.

I finished up by going through another sedimentation tank. This was to make me leave the bacteria in the plant. They tried to get out and go to the river with me. They had to stay behind to clean other dirty water. You wouldn't want them to get into the river because they had all that dirt that had been cleaned off me and all the other kinds of dirty water.

The people who work in the waste water treatment plants are called operators. They have to see that all the equipment is working right and make sure that we go into the right tanks. The operators had to inspect me and test me in the plant laboratory to be sure that I was clean enough to be put back into the river. The operators also had to take care of all that dirt that I left behind.

I think the operators are very important people. Don't you?

Say, I hope your city has a waste water treatment plant with enough operators to do a good job of cleaning up waste water. Maybe you can visit your waste water treatment plant and watch the operators clean the dirty water.

Remember, water needs to be clean before it goes back to the river.

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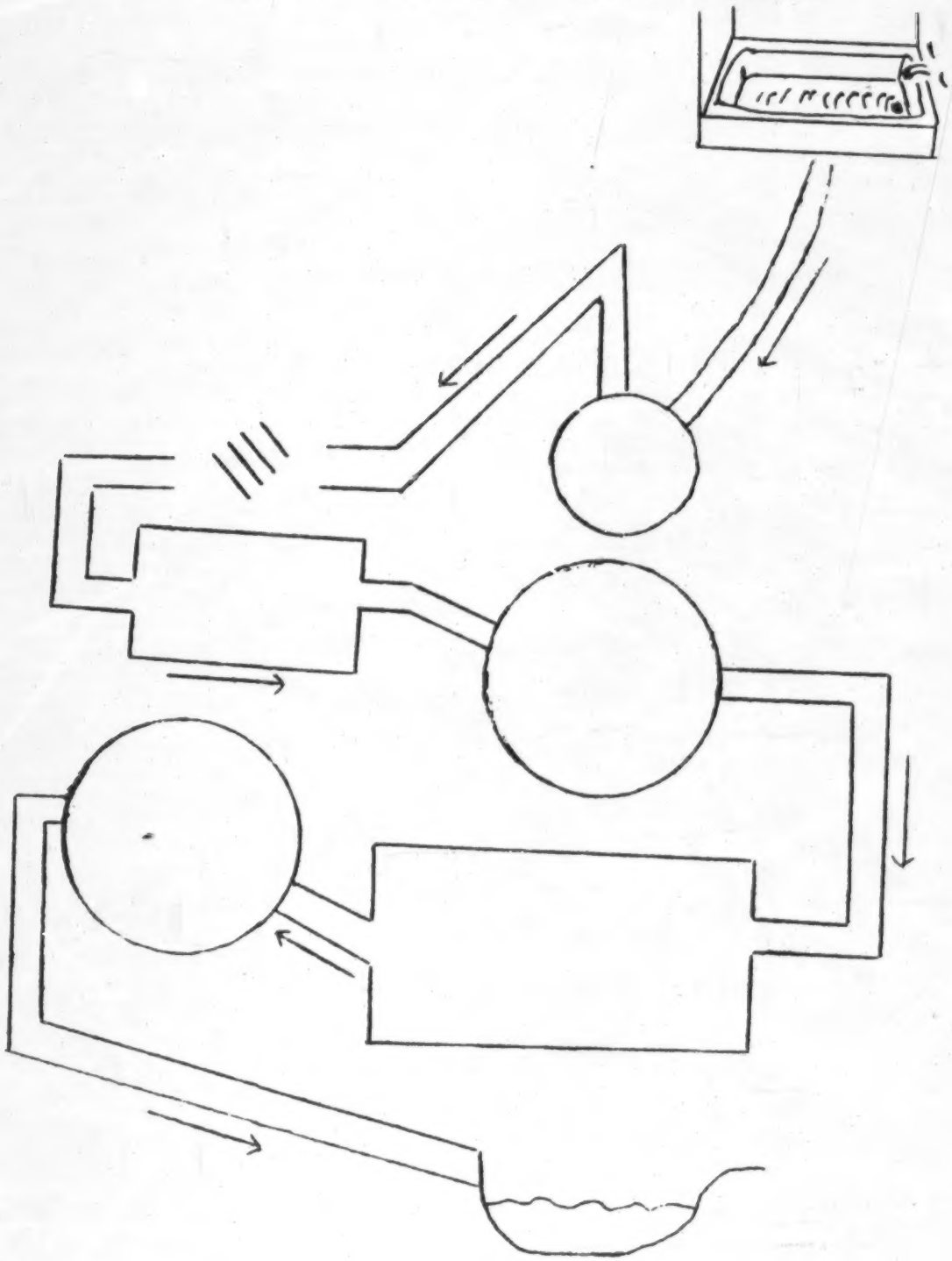
APPENDIX IV

Where Did The Water Go When I Drained the Bathtub?



DIRTY BATHWATER
HELPFUL BACTERIA
SEWER
RIVER
GRIT TANK
SCREEN
PRIMARY SETTLING TANK
SECONDARY SETTLING TANK
PUMP

APPENDIX V

The Question Box

1. Can you always tell just by looking at water if it is safe to drink?
2. Name one of the worst polluters of water.
3. How do cities sometimes cause water to become polluted?
4. Why does the water treatment plant put chlorine into the water?
5. Name four chemicals that the water treatment plant puts into the water.
6. What is used to filter the water at the water treatment plant just before it goes out to the city to be used?
7. Why is it necessary to treat our water before it is used?
8. Name two different things that can be harmed by polluted water.
9. Give three reasons why we need clean water.
10. Give one reason why wildlife needs clean water.
11. Why are feedlots sometimes a cause of water pollution?
12. Name three recreational needs for clean water.
13. What is primary sewage treatment?
14. What is secondary sewage treatment?
15. How many gallons of water do most people use around home each day?

NOTE: Have students help make up questions.

APPENDIX VI

Unit Related Audiovisuals

Subject		Type	Source	Call No.	School(s)
Water Pollution	America In Trouble	FS	HATI	614	Landon
Water Pollution	Crisis of the Environment	K	NEW	614	French, Potwin
Water Pollution	Dirty Water	GA	URBA	333.9	French
Water Pollution	Environmental Crises	K	STUD	614	Landon
Water Pollution	Freshwater Pollution	FS	WARD	333.9	Topeka High, French, Stout
Water Pollution	Great Lakes: The Causes of Pollution	FS	LIFE	333.9	East Topeka Jr.
Water Pollution	Great Lakes: The Results of Pollution	FS	LIFE	333.9	East Topeka Jr.
Water Pollution	Marine Pollution	FS	WARD	333.9	French, Stout
Water Pollution	Nature of the Crisis	FS	WARD	333.9	Topeka High, Stout
Water Pollution	Pollution Control	FS	WARD	333.9	Topeka High, French
Water Pollution	Pollution	FS	TROL	333.7	Rice, Stout, Whitson
Water Pollution	Squandered Resources	K	NEW	333.7	Curtis, French

APPENDIX VII

Film Synopsis

WILD RIVER CONSERVATION Ed. Hor. 14 min. C 1965

Away from the rush of urban living, along the banks of a wild river, an impressively beautiful geographic region of United States is explored. Undisturbed, these water communities thrive and provide a web of life for woodland creatures, a water supply for towns, a haven for city-weary citizens and a pathway of beauty to endure from generation to generation. . .but suddenly, a glimpse of man's careless interference shows how nature's balance can be upset and how a rich heritage can be destroyed.

BIRTH OF A RIVER Trumbull 10 min. C 1965

This important story of geology explains and defines the water table and shows the ideal watershed area and explains how most rivers are created.

LAKES: AGING AND POLLUTION Centron 15 min. C 1971

Examines the typical plants, fish and animal life, and changing water quality as lakes change from youth to death. Special emphasis is placed upon man's impact in speeding up the aging process.

PROBLEMS OF CONSERVATION: OUR NATURAL RESOURCES EBE 11 min. C 1970

Visualizes the waste and ravage made of the earth by man. Explanation is given concerning areas of research aimed at replenishing the fast dwindling natural resources and the dramatic need for action to be taken.

ENVIRONMENT IN CRISIS: THE AGING OF LAKES EBE 14 min. C 1971

After introducing geological and ecological factors of normal aging of lakes, the film zeroes in on how man is speeding up this natural process.

APPENDIX VIII

Instructions for Administering Student Test

1. This test may be given individually or as a group.

2. The student's first and last name should be on the test paper.

3. Each question relates to a specific objective (question 1 relates to objective 1). If you do not teach a certain objective, skip that question.

4. The questions may be read to the students.

5. Feel free to lower the vocabulary of the questions. Be sure the students understand what the question is asking.

6. There is only one answer per question.

7. Students may circle the letter to indicate their choice, or they may underline their answer. As a teacher, you are free to change the method by which they indicate their answers to fit your own situation.

8. The correct answer for each question is listed below.

1.	(C)	7.	(A)	13.	(A)
2.	(A)	8.	(D)	14.	(C)
3.	(D)	9.	(C)	15.	(B)
4.	(C)	10.	(A)	16.	(D)
5.	(B)	11.	(B)	17.	(B)
6.	(A)	12.	(C)		

WATER POLLUTION

Pretest 081, Posttest 082

1. Which of these would have the greatest need for clean water?

   a. trees and soil
   b. houses and cars
   c. people and wildlife
   d. plants and planes

2. The main reasons that people need clean water are for recreation and personal health.

   a. true b. not true

3. How many gallons of water do most Americans use around home each day?

   a. 30 gallons
   b. 50 gallons
   c. 40 gallons
   d. 60 gallons

4. Which of these are considered to be the main polluters of our rivers and streams?

   a. boats and ships
   b. wildlife and plants
   c. factories and cities
   d. planes and fishermen

5. Which of these would be considered a possible polluter of streams in Kansas?

   a. wildlife
   b. feedlots
   c. cars
   d. trees

6. Some water pollution is caused by nature.

   a. true b. not true

7. Which of these uses of untreated water would be most likely to make people sick?

   a. drinking
   b. swimming
   c. fishing
   d. bathing

8. Which of these activities would probably <u>not</u> be permitted around or in a badly polluted lake?

   a. hiking
   b. boating
   c. picture taking
   d. swimming

9. Which of these would probably be harmed the most by dumping untreated sewage into the water?

   a. birds
   b. boats
   c. fish
   d. plants

10. Which of thes is used by most cities to clean up water before it is used in homes and businesses?

    a. treatment plants
    b. water towers
    c. water pumps
    d. pollution plants

Water Pollution
Pretest 081, Posttest 082

11. All cities and towns have waste water treatment plants.

    a. true b. not true

12. The water treatment plant adds lime, carbon, soda ash, alum, fluoride, and:

    a. iodine c. chlorine
    b. calcium d. salt

13. What should factories and cities do with water they have used?

    a. Run it through a waste water treatment plant.
    b. Let it run out on the ground and soak in.
    c. Let it run right into the river through a pipe.
    d. Use it to make a big lake.

14. Which of these materials is used in the water filter at the water treatment plant?

    a. dirt c. sand
    b. alum d. chlorine

15. At the waste water treatment plant, heavy, solid materials are removed from the water by:

    a. secondary treatment c. bacteria treatment
    b. primary treatment d. sludge pump

16. Which of these does the water treatment plant mix into the water to kill harmful germs?

    a. alum c. soda ash
    b. lime d. chlorine

17. Which of these is a part of the secondary waste water treatment?

    a. grease trap c. grit tank
    b. bacteria d. screen